



Spawning aggregations

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Spawning aggregations—hundreds of thousands of fish coming together simultaneously to reproduce—are one of the most impressive biological events in the marine environment. These congregations are carried out by many different species at given times of the year, during a specific lunar phase (mostly full moon or new moon), and in locations with very specific characteristics. Seamounts, in particular, are typical habitats where spawning groups are frequently observed, mainly because of the presence of strong currents and upwelling, pronounced slopes, and a great variety of benthic species like black corals and sea fans that cover the seafloor and provide shelter for many fish species.

Spawning aggregations are, indeed, impressive events to watch. The sheer number of fish that cover the seascape is in itself imposing, but the behavior and color display of each individual makes the spectacle truly amazing. In most species, males become floating rainbows, trying to impress the females with the metallic blue and green colors in their heads, fins, and tails. Meanwhile, the females display their bulging bellies where they keep thousands of eggs that will be released for fertilization by the gametes of more than a dozen males. Courtship usually begins in the early hours of the afternoon when the schools begin to condense and each male tries to remain close to a selected female until spawning time. At dusk, females begin to repeatedly rise to the surface to immediately

An aggregation of yellow snappers *Lutjanus argentiventris* showing the swollen abdomens of the females before spawning. Photo © Octavio Aburto-Oropeza.

descend towards the rocky bottoms. Dozens of males surround them, but only the fastest and most vigorous manage to keep up with their ups and downs. Finally, the time comes. The sun has disappeared below the horizon and the twilight barely allows one to see the immense fish clusters, formed now by each individual female and her many suitors, ascending towards the surface like fireworks whose flares are actually bursts of milt and eggs released close to the surface. Finally, the frenzy stops and, in total darkness, the reef becomes quiet and calm until the next reproductive event of the following day.

Group spawning usually continues for several days or even weeks, often associated with the moon-driven tidal currents that disperse the eggs and larvae away from the spawning site. Seamounts and rocky reefs are extremely important places for the procreation of marine life, functioning as life-generating sources from where larvae are dispersed into the wider sea. There are two important elements that allow the identification of a spawning aggregation event. First, the density of individuals increases at least one order of magnitude above the normal density of the species. Secondly, the individuals migrate to specific locations that may be at considerable distances from their usual home ranges. These two characteristics, together with the fact that spawning locations are predictable because of their association with seamounts and reefs, make reproductive aggregations inherently vulnerable to fishing activities. In a few hours, with a small boat and using a gill net (*chinchorro*), a single fisherman can remove several tons of actively spawning fish, preventing them from completing their life cycle and from producing millions of fertilized eggs needed to renew the populations in the future. In fact, the staggering increase of fishing pressure over spawning aggregation sites has caused an alarming decrease in species with gregarious reproduction, a fact that threatens to drive these species towards extinction in many parts of the world.

Spawning run of the Gulf grunion
Leuresthes sardina endemic to the Gulf
of California. Photo © Octavio Aburto-Oropeza.

Pages 70–71:
Aggregation of leopard groupers
Mycteroperca rosacea, a species
of high commercial value.
Photo © Octavio Aburto-Oropeza.









Several species of sharks, stingrays, groupers, snappers, jacks, and parrotfish form spawning groups in the Gulf of California, and all of them are targets for commercial fishing, sportfishing, and traditional fishing. Despite the attention this region has drawn as one of the most biologically diverse seas of the world, few efforts have been made to study, manage and conserve these reproductive phenomena. Examples of the most impressive spawning aggregations are the corvinas, including the totoaba, which form massive aggregations in spring to reproduce at the Colorado River delta. With its steel blue color, two meters in length, and weighing over 100 kilograms, the totoaba once crowded the delta waters during their reproductive migration time at the end of spring. At the beginning of the 20th century, the species was so abundant that the great fish could be caught from boats or even from the shore with merely a hand-held harpoon. In 1943, 2,000 tons were landed, the maximum capture ever recorded. In 1975, the year in which totoaba fishing was finally prohibited, a decrease in fresh water in the delta and the uncontrolled fishing of the species had reduced the populations and collapsed the fishery to less than 20 tons a year. The totoaba is one of the few commercial fish species included in the list of protected species in Mexico. The Gulf corvina, a species taxonomically close to the totoaba and also a beneficiary of the rich ecosystem of the Colorado River delta, faces now in the 21st Century a similar history of exploitation — a product of unregulated and excessive catches during their reproductive activities. If this scenario continues, it is possible that the Gulf corvina will face the same destiny as all species that form aggregations to reproduce in the spring (a period of high demand for fishing products as it coincides with the Catholic time of Lent).

Fishery of the Gulf corvina
(a croaker) at Golfo de Santa Clara
in the Colorado River Delta.
Photo © Octavio Aburto-Oropeza.

During our stay at Las Animas we had the opportunity to observe one of the most spectacular reproductive events we have ever observed at a seamount. Temperature was

ideal ($>28^{\circ}\text{C}$), it was only half an hour before sunset, and the currents were strong. We jumped into the water and swam until we found a place protected from the currents where we could get a better view of the spectacle that was developing. The yellow snappers (*Lutjanus argentiventris*) started first, forming compact groups of 30 to 50 individuals that came in and out between the crevices and cavities of the rocks. The red heads, which show up from the yellow bodies during reproductive season, stood out against the turquoise water and the shadows of the nooks and cracks where the courtship took place. Soon, three other species of snappers appeared—Pacific dog snapper (*Lutjanus novemfasciatus*), mullet snapper (*L. aratus*), and Mexican barred snapper (*Hoplopagrus guentherii*)—whose abundance and bright colors left no doubt about their reproductive condition. These species normally display their courtship between the rocks and near the surface, approaching and then retreating away from the reef, so it is very difficult to observe and document their reproductive behavior. In contrast, benthic species use the reef to dance and flirt before spawning. Males generally compete for the best territory to captivate more than one female. In fact, we were surrounded by male giant hawkfish (*Cirrihus rivulatus*). The males with territories, known in behavioral ecology as “alpha males”, fought against males that were not able to secure a territory of their own, known as “satellite males” because they constantly swim around occupied territories trying to reproduce with one of the three to five females that have been secured by the alpha males. When the time comes, alpha males start to swim frantically with the females, one at a time, distancing themselves from the rock to the surface, where they release a small cloud of gametes. The satellite males take advantage of the opportunity to seduce one of the females that remain in the territory, so they too can swim to the surface and release their sperm in the cloud of eggs that the female spawns. The dominant male usually notices

this and chases away the opportunist, then comes back quickly to reproduce as soon as possible with the female seduced by the impostor. This is repeated countless times during the 20 minutes that the reproductive activity lasts, requiring an impressive amount of energy from the alpha males, the strongest and biggest males of the reef.

That day at Las Animas, we were lucky enough to observe at least 14 species of fish and two species of mollusks (red clam and black mussel snail) in a reproductive frenzy that we had never witnessed before. The climax of the event happened towards the end when dozens of Pacific creolefish (*Paranthias colonus*) covered the landscape and began to spawn in clusters of fish balls near the surface. This species is currently one of the main coastal fisheries in the region and is known by the fishers as “sandía” (“watermelon” in Spanish). The name refers to the red coloration that the individuals acquire during the reproductive season, which becomes apparent mainly in the caudal fin that has a crescent shape like a red watermelon slice. If this name, on the one hand, demonstrates the close relationship fishers have with the resources they catch, it also highlights one of our greatest weaknesses in the sustainable use of fisheries: the high correlation between the reproductive seasons and the main fishing seasons.

Over the last three decades there has been an enormous increase in fishing pressure in many areas of the Gulf of California, which has resulted in substantial decreases in the landings of many gregarious species. For example, fish like the Gulf Grouper (*Mycteroperca jordani*), Goliath Grouper (*Epinephelus itajara*), and Broomtail Grouper (*Mycteroperca xenarcha*) represented important fisheries in the 1970s, but today have collapsed. Fisheries are now concentrating in congregations of smaller fish, like seabasses, snappers, and parrot fish, many of which are also decreasing.

The crisis facing the conservation of spawning aggregations has been globally recog-

nized. As a result of this growing concern, a “Call for Action” was subscribed in the second International Tropical Marine Ecosystems Management Symposium (ITMESM) in March of 2003. The key recommendation was:

Fish spawning aggregations must be conserved through sturdy management strategies. This should include, to the extent possible, complete protection to ensure the permanence of the populations that make up these aggregations, the integrity of the reef ecosystem, and the sustainability and food supply for the communities that depend on these gregarious species.

It is obvious that these reproductive aggregations need to receive more attention from fishing administrators and the general public, and at the same time, that the vulnerability of this ecological process needs to be placed as a top priority in conservation, research and management agendas. The time has come for large-scale collaboration between the interested parties to protect and conserve spawning aggregations in all marine ecosystems.

Advertising reproductive maturity
with red coloration, a school of
creolefish *Paranthias colonus*
aggregates to spawn.
Photo © Octavio Aburto-Oropeza.

